

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (Original): A method for forming a variable astigmatic focal beam spot to cut a substrate, said method comprising the steps of:

- generating a raw laser beam;
- expanding said raw laser beam;
- modifying said expanded beam such that said modified beam is collimated in one principal meridian and converging in another principal meridian;
- focusing said modified beam having two separate focal points to produce an astigmatic focal beam spot having an elongated shape; and
- directing said astigmatic focal beam spot at said substrate to obtain at least a partial cut in said substrate.

Claim 2 (Original): The method of claim 1 wherein said raw beam is generated using a solid state laser.

Claim 3 (Original): The method of claim 2 wherein said raw beam is generated in a UV range less than about 400 nm.

Claim 4 (Original): The method of claim 3 wherein said raw beam is generated with a pulse duration less than about 40 ns.

Claim 5 (Original): The method of claim 1 wherein the step of expanding said raw beam includes passing said raw beam through a beam expanding telescope.

Claim 6 (Original): The method of claim 1 wherein the step of modifying said expanded beam includes passing said expanded beam through an anamorphic lens system comprising a cylindrical plano-concave lens and a cylindrical plano-convex lens.

Claim 7 (Original): The method of claim 1 further comprising the step of varying the convergence of said modified beam.

Claim 8 (Original): The method of claim 1 wherein the step of modifying said expanded beam includes passing said expanded beam through a single anamorphic lens to provide a fixed convergence.

Claim 9 (Original): The method of claim 1 further comprising the step of symmetrically cropping low intensity edges of said expanded beam.

Claim 10 (Original): The method of claim 1 wherein the step of focusing said modified beam comprises passing said modified beam through a beam focusing lens, wherein said focused beam has two separate focal points, wherein one of said focal points is shorter than a nominal focal length of said beam focusing lens and the other of said focal points is formed generally at said nominal focal length of said beam focusing lens.

Claim 11 (Original): The method of claim 1 wherein said substrate includes sapphire.

Claim 12 (Original): The method of claim 11 wherein said substrate includes a GaN layer on said sapphire, and wherein said astigmatic focal beam spot is directed at a surface of said GaN layer such that laser energy is coupled into said GaN layer to cause ablation of said sapphire.

Claim 13 (Original): The method of claim 1 wherein said substrate is part of a semiconductor wafer including a device layer on said substrate.

Claim 14 (Original): The method of claim 1 wherein said substrate is made of a material selected from the group consisting of metal, GaAs, silicon, GaP, InP, Ge, alumina, glass and polymers.

Claim 15 (Canceled)

Claim 16 (Original): The method of claim 1 wherein said astigmatic focal beam spot has a width of less than about 20 μm .

Claim 17 (Original): The method of claim 16 wherein said astigmatic focal beam spot has a width of about 5 μm .

Claim 18 (Original): The method of claim 1 further comprising the step of moving said substrate in a cutting direction along a length of said astigmatic focal beam spot.

Claim 19 (Original): The method of claim 1 wherein the step of modifying said expanded beam includes creating a plurality of separated astigmatic beamlets.

Claim 20 (Original): The method of claim 19 wherein the step of modifying said expanded beam includes controlling at least one of a length of said beamlets and a distance between said beamlets.

Claims 21 – 40 (Canceled)

Claim 41 (new): The method of claim 13 further comprising moving said semiconductor wafer along a length of said astigmatic focal beam spot to form at least one scribe line in said semiconductor wafer.

Claim 42 (new): The method of claim 41 wherein moving said semiconductor wafer along a length of said astigmatic focal beam spot includes moving said semiconductor wafer to form a plurality of scribe lines in said semiconductor wafer.

Claim 43 (new): The method of claim 42 further comprising separating said semiconductor wafer into dies using said plurality of scribe lines.

Claim 44 (new): The method of claim 1 further comprising:

moving said substrate in a cutting direction along a length of said astigmatic focal beam spot such that at least one said at least a partial cut is formed in an x direction on said substrate;

rotating said substrate about 90 degrees; and

moving said substrate in a cutting direction along a length of said astigmatic focal beam spot such that at least one said at least a partial cut is formed in a y direction on said substrate.

Claim 45 (new): The method of claim 6 further comprising varying said astigmatic focal beam spot by varying a spacing between said cylindrical plano-concave lens and said cylindrical plano-convex lens.

Claim 46 (new): The method of claim 12 further comprising moving said sapphire substrate along a length of said astigmatic focal beam spot to form at least one scribe line in said sapphire substrate.

Claim 47 (new): The method of claim 46 wherein the step of moving said sapphire substrate along a length of said astigmatic focal beam spot includes moving said sapphire substrate to form a plurality of scribe lines in said sapphire substrate.

Claim 48 (new): A method for forming a variable astigmatic focal beam spot to cut a substrate, said method comprising:

generating a raw laser beam;

expanding said raw laser beam;

modifying said expanded beam such that said modified beam is collimated in one principal meridian and converging in another principal meridian;

focusing said modified beam having two separate focal points to produce an astigmatic focal beam spot having an elongated shape; and

directing said astigmatic focal beam spot at said substrate to obtain at least a partial cut in said substrate, wherein said substrate includes a metal film made of a metal selected from the group consisting of molybdenum and copper.

Claim 49 (new): A method for forming a variable astigmatic focal beam spot to cut a substrate, said method comprising:

generating a raw laser beam;

expanding said raw laser beam;

modifying said expanded beam such that said modified beam is collimated in one principal meridian and converging in another principal meridian;

focusing said modified beam having two separate focal points to produce an astigmatic focal beam spot having an elongated shape;

applying a water soluble protective coating to said substrate, said protective coating including at least one surfactant in a water-soluble liquid glycerin; and

directing said astigmatic focal beam spot at said substrate to obtain at least a partial cut in said substrate.